ABSTRACT FOR SPRING 1995 MRS MEETING

Submitted to Symposium G
Symposium Title: Structure and Properties of Multilayered Thin Films

THERMALLY ACTIVATED SOLID STATE REACTIONS IN AL/ZR AND AL/MONEL 400 MULTILAYERS, T. W. Barbee, Jr., M. A. Wall and T. P. Weihs, Chemistry and Materials Science Department, Lawrence Livermore National Laboratory, Livermore, CA, 94551

Solid state reactions between Al/Zr layers and Al/Monel 400 in thick (> 15 μm) Al/Zr & Al/Monel 400 multilayers were studied using Differential Scanning Calorimetry (DSC) and X-ray diffraction (XRD) and in situ heating TEM. The multilayer samples were magnetron sputter deposited as alternate layers 4 to 50 nm in thickness: total film thicknesses range from 15 to 50 μm. When the samples were DSC scanned at a heating rate of 50 C/min from 25°C to 725°C several exotherms were observed and quantitatively characterized. In Situ heating cross-section and plan view TEM with XRD analysis provided a quantitative evaluation of the phases formed and the microscopic structural reaction paths followed. These observations provide specific information as to interfacial reactions during synthesis as well as the reaction paths followed during thermally activated decomposition of these structures. The phases observed in the Al/Zr multilayers include Al_3Zr, Al_3Zr_2, AlZr and $AlZr_2$. In the Al/Monel 400 system all phases expected for the Al/Ni system as well as $CuAl_2$ were formed. Mechanisms for the reactions in these layered structures and the microstructures formed will be discussed and their relation to as-synthesized structures discussed.

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